steer davies gleave

Estimates of Station Usage 2014-15 - Methodological Report

Methodology and Validation Report
December 2015

Office of Rail and Road

Our ref: 22670601
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Introduction

1. This report explains the information contained within the Office of Rail and Road's (ORR) Estimates of Station Usage dataset ('Estimates of Station Usage 1415.xlsx') and provides guidance on the methodology followed during the process of creating this file for the financial year 2014/15. It also includes a summary of the validation checks undertaken as part of the production process.
2. The Estimates of Station Usage dataset (referred to in the rest of this report as "Station Usage dataset") consists of estimates of the total numbers of people:
   - Travelling from or to the station (entries & exits); and
   - Interchanging at the station (interchanges).
3. Information is given for all the national rail stations in England, Scotland, and Wales based on tickets sales data. These results are the most recent in a series produced for the ORR since 1997/98 and the spreadsheet is in a similar format to those previously published.
4. Station Usage data is generated from the Origin Destination Matrix (ODM), a comprehensive matrix of rail flows throughout England, Scotland and Wales, also produced by Steer Davies Gleave, and based on data produced for the MOIRA2 rail planning tool which itself is derived from LENNON, the rail industry's ticketing and revenue system. This does place some limitations on the data which users should be aware of and these are detailed in this report.

Methodological Development

5. Consistency with past datasets is important to enable comparisons to be made over time. However, stakeholders have indicated that they are keen to see improvements, even where this reduces consistency with historic data, provided any changes are clearly explained.
6. In the 2014/15 dataset a number of methodological improvements have been implemented:
   - Improved infill for the Tyne & Wear PTE area;
   - Improved count-based distributions at some group stations;
   - Improved distribution of demand at some stations in and around Southend;
   - Adjustment to account for change in recording of PAYG journeys in LENNON;
   - Adjustment to account for London Bridge engineering works; and
   - Adjustment to journeys to/from Digby & Sowton station to address issue relating to recording of journeys associated with a season ticket product for students.

Results

7. In total entries and exits have increased by 4.5% to 2.79bn in 2014/15 from 2.67bn in 2013/14.

Limitations of the data

8. In the absence of a fully gated system that allows a complete recording of flows through stations or comprehensive and robust count data, the use of ticket sales data (LENNON)

as the primary source of the Station Usage dataset as described in this report is the best approach available. In particular its national coverage makes it suitable as a basis for the production of Official Statistics such as those reported by the ORR.

9. However, this data does have weaknesses when utilised for this purpose and, although some of these are catered for in the methodology, the user should be aware of these acknowledged limitations and bear these in mind when using the data. The key limitations are outlined in Chapter 1 with more extensive discussion of some aspects of the limitations of the dataset included in Appendix E.

1 Introduction

Overview

1.1 Steer Davies Gleave was appointed by the Office of Rail and Road[1] (ORR) to produce the Estimates of Station Usage dataset for 2014/15, continuing the historic series that dates back to 1997/98. This report accompanies the Estimates of Station Usage dataset for 2014/15 and provides details of the process and outputs used to produce the statistics on behalf of the ORR. In the rest of this report the Estimates of Station Usage dataset is referred to as the "Station Usage dataset."

1.2 The Station Usage dataset is generated from the Origin Destination Matrix (ODM), a comprehensive matrix of rail flows throughout England, Scotland and Wales, also produced by Steer Davies Gleave, and based on data produced for the MOIRA2 rail planning tool which itself is derived from LENNON, the rail industry's ticketing and revenue system.

1.3 Steer Davies Gleave are providing the ORR with an MS Excel file, ('Estimates of Station Usage 1415.xlsx') containing entries, exits and interchanges made at stations throughout England, Scotland and Wales, for the financial year 1st April 2014 to 31st March 2015. For the entries and exits, figures are split into the three main categories of the available ticket products (Full, Reduced, and Season).

1.4 The underlying methodology adopted by Steer Davies Gleave in the production of the Station Usage data is consistent with that adopted by DeltaRail in the production of the Station Usage dataset in the years prior to 2011/12. However a number of updates to the methodology have been implemented by Steer Davies Gleave over recent years which have been documented in this and previous annual reports.

Use of the Station Usage dataset

1.5 When using the Station Usage data, particularly when comparing with previous years, it is important to be aware of:

- Improvements made to the dataset over time which can impact consistency between years;
- Limitations of the data and specifically factors e.g. some ticket sales not being included, that may mean that demand on particular flows or stations is underestimated; and
- Factors which can affect reporting of entries and exits.

Improvements to the dataset

1.6 Improvements to the dataset in 2014/15 are set out in Chapter 3. A summary of improvements made over recent years are further detailed in Appendix A. The ORR continues to work with stakeholders and its own consultants to improve the robustness of the dataset by implementing methodological changes that demonstrate value and address acknowledged issues.

[1] The Office of Rail Regulation was renamed the Office of Rail and Road from 1st April 2015.

Limitations of the data

1.7 In the absence of a completely gated system that allows a complete recording of flows through stations or comprehensive and robust count data the use of ticket sales data, LENNON, as the primary source of the Station Usage dataset as described in the following chapter is the best approach available. In particular its national coverage makes it suitable as a basis for the production of Official Statistics such as those reported by the ORR.

1.8 However, this data does have weaknesses when utilised for this purpose and, although some of these are catered for in the methodology, the user should be aware of these acknowledged limitations. The key limitations are outlined below. More extensive discussion of some aspects of the limitations of the dataset is included in Appendix E.

- **Non-Point to point tickets** - An overarching issue is the inherent difficulty and uncertainty associated with estimating the number of journeys associated with many rail products which do not simply represent point to point single or return journeys and furthermore the distribution of those journeys. This is a particular issue for the London Travelcard Area and Passenger Transport Executive (PTE) areas;
- **Concessionary travel** – Transport for London (TfL) and most PTEs subsidise some form of free travel for certain types of users including those over a certain age, students and those with disabilities. This creates a substantial additional element of demand which is very difficult to include in the Origin Destination Matrix (ODM) as information on the level and distribution of journeys associated with these free travel products is not recorded and will not even have point of sale information. The current approach to this in the ODM is to include this demand where data has been made available by TfL/PTEs which would generally be estimates as a result of surveys;
- **Non-LENNON Sales** - A significant proportion of sales is either not passed directly through LENNON (sold at non-railway sales points) or is included in LENNON in a format which requires additional processing and assumptions i.e. is not associated with a station to station flow;
- **Group stations** – Many products to major destinations are sold with the origin or destination as a group of stations (e.g. London Terminals, Manchester BR stations). Current industry data does not distinguish between the component stations and therefore a split between these stations has to be estimated during the production of the ODM; and
- **Ticketless travel** – Journeys associated with ticketless travel are not included in the datasets but as with journeys made on other products excluded from the datasets, some journeys would be observed in passenger counts. This is likely to be an issue on some flows and in some areas where ticketless travel is significant. As more stations have become gated over time and rail operators focus on revenue protection activities this is likely to be less of an issue than in the past in contributing to a shortfall in journeys. Finally, there is a strong argument that it is inappropriate to include ticketless travel in the Station Usage dataset as its purpose is to record bona-fide journeys on the rail network and inclusion of ticketless travel could distort business cases for new investment where these are reliant on Station Usage data.

1.9 It is important to remember that in aggregate the underlying data, from LENNON, is a rich and comprehensive data source and importantly covers the entirety of Great Britain. The issue is that when using the data source (in particular for Station Usage statistics) the data is being

pushed significantly beyond what it was originally designed for which was primarily to report and allocate revenues across train operators.

Factors which can affect reporting of entries and exits

Adverse Weather

1.10 Cases of extreme adverse weather may cause disruption to normal railway operations, for example the collapse of the sea wall at Dawlish in February 2014. Such events can impact on travel patterns.

Gating Schemes

1.11 Installation of ticket gates can significantly affect not only the usage figures at that station, but also those at neighbouring stations. The gates help to ensure that customers purchase tickets, but customers may also alter their travel patterns to avoid gated stations. We would expect travel patterns to be most affected in the months following the installation of the gates.

Change in Service Pattern

1.12 Alterations in service frequency or stopping pattern would be expected to alter Station Usage figures. This is particularly apparent where a group of stations along a line show similar increases or decreases. Again, this can be a long-term trend.

Ticket Issuing Facilities Changes or Product Changes

1.13 Some London stations have both underground and National Rail trains operating. LENNON does not capture tickets sold by London Underground, only those sold by Train Operating Companies (TOCs). Changes in ticket facilities provided by TOCs, for example the provision of ticket machines, can therefore increase the ticket sales captured by the system.

1.14 Product changes can have an effect on passengers' purchasing patterns at rail outlets thus affecting Station Usage data. For example, the introduction of Oyster cards and, more recently, Contactless Payment can affect stations inside the Travelcard boundary in the London area.

Engineering Work

1.15 Significant engineering work can alter customers' travel patterns, either causing passengers to not travel, use an alternative mode or use an alternative rail route. Similarly, significant delays can alter travel patterns where, for example, Virgin Trains customers on the West Coast can switch to using Chiltern Trains services to travel between the West Midlands and London.

Advance tickets

1.16 Advance tickets can be sufficiently cheap to incentivise travellers to purchase a number of tickets but only use one dependent on how their circumstances change, creating an inflated number of trips in the ticket sales data. This can be particularly true for business travel and could overstate actual journeys.

Tourism/Leisure

1.17 Stations near to tourist and leisure attractions may show significant changes in usage as a result of weather, promotions or other factors, which affect tourists' journeys.

New/Special Stations

1.18 Some stations serve a particular activity or business. Some fluctuation in usage of such stations is reasonable. Such activities include:

- Sporting Events e.g. Wembley Stadium, Newbury Racecourse;
- Special Events e.g. Birmingham International (for the National Exhibition Centre), Exhibition Centre Glasgow;
- Airports, where rail demand is closely linked to airport passenger numbers e.g. Gatwick Airport, Stansted Airport.

1.19 In addition, where there are new stations ramp up effects can cause large demand increases over a number of years.

Trend of Growth or Decline

1.20 For stations with a history of growth or decline, it is reasonable to expect this trend to continue. There are many possible reasons for these trends, such as demographic and employment changes (new developments in the vicinity), changes in rail service levels or new stations abstracting demand.

Changes in the Sales of Individual Ticket Types

1.21 Miscoding of ticket information entered into LENNON can alter Station Usage results, although this would not be reflecting an actual change in customers' journeys.

Historic Events

1.22 There are a number of factors worth taking into account when considering generic annual data:

- Years may have been affected by industrial action;
- Major incidents affecting services such as those at Southall (1997), Ladbroke Grove (1999), Hatfield (2000) and Grayrigg (2007);
- Changes to on-train ticket sales and revenue protection policies including installing ticket gates can result in an increase in recorded journeys and revenue;
- Infrastructure changes can significantly affect recorded journeys. For example engineering and upgrade work can result in temporary line closures and new lines and new connections between stations can increase recorded journeys. Examples include the opening of the Airdrie-Bathgate line.

2 Methodological Overview

MOIRA2 Demand Matrix – Base Data

Overview

2.1 All estimates of Station Usage, exits, entries and interchanges included in the Station Usage dataset, are derived from the Origin Destination Matrix (ODM), also produced by Steer Davies Gleave for the ORR. The ODM is, in turn, derived primarily from the MOIRA2 Demand Matrix.

2.2 The demand matrix is sourced from MOIRA2 and includes a comprehensive representation of travel on the national rail network. The base data for the MOIRA2 demand matrix is LENNON ticket sales, with the addition of "infills" for London Travelcards, airport links and multi-modal and zonal products sponsored by Passenger Transport Executives (PTEs)[2].

Underlying Base Data - LENNON

2.3 The underlying matrix of ticket sales and associated journeys and revenue used in MOIRA2 is derived from LENNON. It is based on an extract from LENNON, produced by Atos, of total sales revenue and journeys for the year, broken down by flow (origin and destination National Location Code (NLC)), route code and by product type (CTOT). However, as there are known omissions in this data in respect of Transport for London (TfL) and PTE sponsored tickets, and non-National Rail tickets on some airport services, there needs to be a "matrix infilling" exercise undertaken. This will enable the estimation of a more complete origin-destination matrix and include the associated journeys and revenue that do not appear in the underlying matrix.

2.4 There are three main cases:

- Tickets with non-geographical destinations, e.g. zonal products, Rovers;
- Tickets sold at some non-National Rail (RSP: Retail Settlement Plan) outlets, e.g. newsagents; and
- Tickets which do not appear in LENNON at all. This includes some TOC tickets on airport flows and tickets for TOCs which fall outside the Rail Settlement Plan.

2.5 Certain tickets with destination codes that are not national rail stations are included in the MOIRA2 demand matrices, being mapped to the corresponding rail station. These 'Rail Links' usually include a third party element, such as to a bus zone, or tourist/leisure attraction. The MOIRA2 demand matrix includes the journeys and the net revenue associated with such tickets.

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[2] Passenger Transport Executives (PTEs) are local government bodies which are responsible for public transport within large urban areas. They are accountable to Integrated Transport Authorities (ITAs) which were formerly known as Passenger Transport Authorities (PTAs) prior to 2008 and the Local Government Act 2008. There are five PTEs in England, for each of the metropolitan counties (Merseyside, South Yorkshire, Tyne and Wear, West Midlands and West Yorkshire) with the former Greater Manchester Passenger Transport Executive being replaced by Transport for Greater Manchester from April 2011. In Scotland the Strathclyde Partnership for Transport is the equivalent body covering the region of Strathclyde. For convenience in this report we continue to refer to these areas as PTEs.

2.6 Data excluded from the MOIRA2 demand matrix is set out in Appendix E.

Ticket Type Definitions

2.7 Within the base demand matrices, journeys and revenue have been sub-divided into the following four ticket types, each of which is further split by First & Standard Class:

- Full: all walk-up undiscounted single or return tickets, whether or not issued with a status discount (child, railcard etc);
- Reduced: all walk-up discounted single or return tickets, whether or not issued with a status discount (child, railcard etc);
- Advance: all advance-purchase tickets; and
- Seasons: all multi-use tickets.

2.8 It should be noted that for the purposes of the Station Usage dataset, Advance products are included in the Reduced ticket category.

Infills for London Travelcards, Major Urban Areas (PTE) & Airports

2.9 Infills are included within the MOIRA2 demand matrix to add in the missing journeys and revenue identified in para 2.4 in three key areas:

- **Within London Travelcard area.** Whilst the underlying matrix includes an estimate of journeys made on Day Travelcards / Travelcard seasons purchased at National Rail stations, it does not include a significant number of national rail trips made using Travelcards purchased at Tube stations, travel shops and newsagents.
- **Within Passenger Transport Executive (PTE) areas.** The underlying matrix excludes virtually all rail trips made on PTE-sponsored tickets, which are usually zonal and often multimodal.
- **Trips to/from Airports.** The underlying matrix includes many trips to/from airports, but excludes all Heathrow Express journeys, and some tickets sold for Gatwick Express, Stansted Express and other airport operators.

2.10 There are also other ticket sales which are not included in the MOIRA2 demand matrix, but these are generally much less significant. It should also be noted that journeys with no associated ticket sales such as staff travel, and particularly fare evaders, are not included in the MOIRA2 demand matrix and therefore are not included in the ODM either.

2.11 The most significant “infills” are for the London Travelcard area (sales made by TfL), and for PTEs, since in both cases a substantial proportion of the rail journeys made use multimodal travelcard type tickets.

2.12 The third infill, for Airports, estimates the significant number of rail journeys on both Gatwick and Stansted Express, made on tickets sold outside of the RSP system i.e. not sold by National Rail outlets. Journeys on Heathrow Express are excluded from the MOIRA2 demand matrix.

Origin Destination Matrix (ODM) PTE Infill

2.13 For the production of the ODM the revenue and journeys associated with the MOIRA2 PTE Infill are removed and replaced with a separate estimate.

2.14 With the initial version of MOIRA2 an improved representation of PTE demand was included in the base demand matrix based on work undertaken by Steer Davies Gleave for the year 2008/09. This included journeys from tickets sold at non-railway sales points and an estimated

distribution of journeys largely based on the distribution of point to point tickets sold in PTE areas.

2.15 Subsequent versions of the MOIRA2 demand matrix have included a PTE infill but the journeys are now based directly on LENNON data and are therefore not consistent with the 2008/09 infill.

2.16 To maintain consistency with previous ORR statistics the PTE infill contained in the ODM has therefore historically been based on the 2008/09 MOIRA2 PTE infill (as described in para 2.14) adjusted annually using growth rates derived from ORR's National Rail Trends (NRT) data. Up until 2010/11 the application of growth was carried out at a highly aggregate level based on growth seen for 'franchised regional operators' as reported in National Rail Trends data.

2.17 From 2011/12 onwards a number of improvements have been made in successive years to the methodology for the construction of the PTE infills. In the construction of the 2011/12 dataset a more disaggregate set of growth rates was applied at the PTE level based on LENNON data. In addition, a completely new infill was included for the West Midlands Centro PTE area based on an infill constructed for the Passenger Demand Forecasting Council (PDFC) by Steer Davies Gleave. Further improvements were made in 2012/13 with the inclusion of new infills for the West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TfGM) PTE areas based on work undertaken by Mott MacDonald for Rail in the North (RiN). In 2013/14, new infills were included for South Yorkshire (SYPTE), Merseyside and Strathclyde (SPT).

2.18 In the 2014/15 dataset, a new infill for Tyne & Wear has been included.

2.19 In summary, as a result of these methodological enhancements in all of the PTE areas over the last four years users should be cautious in the comparisons they make over time for stations in these areas.

Table 2.1 Summary Status of PTE Infills Methodology

PTE	Status
Greater Manchester	Updated infill methodology adopted for 2012/13 through to 2014/15
Merseyside	Updated infill methodology adopted for 2013/14 and 2014/15
South Yorkshire	Updated infill methodology adopted for 2013/14 and 2014/15
Strathclyde	Updated infill methodology adopted for 2013/14 and 2014/15
Tyne & Wear	Updated infill methodology adopted for 2014/15
West Midlands	Updated infill methodology adopted for 2011/12 through to 2014/15
West Yorkshire	Updated infill methodology adopted for 2012/13 through to 2014/15

Unknown Destinations

2.20 Ticket sales do not always tell us where a passenger is travelling, for example where the Origin or Destination is a London Travelcard. As in previous years, we have converted unknown destinations into an estimate of the actual stations that passengers are travelling to. The full detail of this part of the methodology appears in Appendix D.

Interchanges Methodology

2.21 An estimate of the number of people interchanging at each station is obtained by combining the number of journeys made on each flow (from the ODM) with the information on passenger journeys taken from the Central Allocations File (CAF).

2.22 The CAF is an output of the ORCATS system which predicts passenger choices of rail route and train used, and determines the allocation of passenger revenue between TOCs. Since ORCATS is a model, the CAF contains estimates rather than actual journeys. However, it is used throughout the rail industry, so it is an appropriate source of data to use for this purpose. Since CAFs are updated with the timetable, not with financial years, no CAF will match the ticket sales data exactly. The December 2014 CAF is used in the creation of the 2014/15 Station Usage dataset.

2.23 The CAF contains:

- Origin and destination;
- Route alternatives for each origin and destination, including all interchange points;
- Ticket type data; and
- For each flow, the proportion of passengers who choose to travel on each route alternative as calculated by the ORCATS model.

2.24 In the 2014/15 Station Usage dataset, an adjustment has been made to account for the engineering work at London Bridge, which is not reflected in the December 2014 CAF file. The methodology of this adjustment is described in paragraph 3.15.

2.25 An overview of the ORCATS allocation process can be found in Appendix C.

3 Methodological Changes in 2014/15

Introduction

3.1 Consistency with past datasets is important to enable comparisons to be made over time. However, stakeholders have indicated that they are keen to see improvements, even where this reduces consistency with historic data, provided any changes are clearly explained.

3.2 In the 2014/15 dataset a number of changes have been made to improve the dataset and these are explained in the rest of this chapter, together with some quantification of their impact.

Tyne & Wear PTE Infill

3.3 Building on the inclusion of improved PTE infills for other areas in previous years, an improved infill for the Tyne & Wear PTE area has been included in the 2014/15 dataset. This was produced using a process derived to construct infill demand for the Rail in the North demand and revenue model produced by Mott MacDonald and MVA for the Rail in the North (RiN) consortium and was supplied by Mott MacDonald. At the total PTE level the impact of the new infill has been to reduce demand by 0.4m relative to the numbers reported in the 2013/14 Station Usage statistics – primarily due to a reduction in the estimate for Sunderland as a result of the change in methodology.

3.4 Table 3.1 shows the changes in the Tyne & Wear PTE area as a result of the new Tyne & Wear infill. The general result of implementing the new infill is a reduction in usage at Newcastle and Sunderland stations and an increase in usage at other stations in the PTE area. As there is a large change in entries and exits at Sunderland arising from implementing the new infill, passenger counts were conducted at Sunderland in order to validate this methodological improvement. The passenger counts gave assurance that this is an appropriate level of demand at Sunderland and therefore, that adopting the new infill would give a more accurate representation of station use at this station.

3.5 It is important that in considering the changes at the stations in Tyne & Wear that they are not necessarily indicative of any underlying reduction or increase in actual station usage but are the result of the methodological changes implemented in this year's data. As the overall effect of the updated infill methodology in Tyne & Wear has been to reduce the number of rail journeys in the infill the impact, in this year's dataset, has been a reported fall in station usage at Newcastle and Sunderland stations. This is a function of the reduction in the total rail journeys in the infill combined with distributional changes associated with the new methodology.

Table 3.1: Changes in Entries and Exits in the Tyne & Wear PTE area due to inclusion of new Tyne & Wear PTE Infill (2014/15)

Station	Change in entries and exits with new infill	% Change
Sunderland	-334,827	- 42%
Newcastle	-164,744	- 3%
Wylam	5,171	4.8%
MetroCentre	821	0.2%
Blaydon	106	2.1%
Manors	18	0.4%

Count-based redistribution of demand at Group Stations

3.6 For tickets where the destination is a station group (such as 'Bedford Stations'), demand is allocated to individual stations based on the methodology described in Appendix D.

3.7 In Spring 2015, passenger counts were conducted at a number of group stations. For 10 Station Groups (21 stations in total), the proportions of demand implied by the station counts have been adopted to allocate demand between individual stations in the group. This adjustment only affects the split of total group station demand and not the absolute level of journeys to/from that station group. Where applicable, this updates the existing methodology described in Appendix A.37. Table 3.2 shows the 2013/14 and 2014/15 demand allocations for the stations in question.

Table 3.2 Changes arising to station group proportions from Spring 2015 station counts

Name	Station Group	2013/14 demand allocation	2014/15 demand allocation (including changes from Spring 2015 counts)
Bedford Midland	Bedford BR	95.5%	95.5%
Bedford St. Johns		4.5%	4.5%
Canterbury East	Canterbury BR	29.8%	30.1%
Canterbury West		70.2%	69.9%
Deepdene	Dorking BR	26.1%	24.7%
Dorking		70.7%	71.9%
Dorking West		3.2%	3.5%
Edenbridge	Edenbridge BR	32.1%	48.8%
Edenbridge Town		67.9%	51.2%
Falkirk Grahamston	Falkirk BR	34.1%	44.2%
Falkirk High		65.9%	55.8%
Helensburgh Central	Helensburgh BR	98.6%	98.2%
Helensburgh Upper		1.4%	1.8%
Newark Castle	Newark BR	16.8%	35.3%
Newark North Gate		83.2%	64.7%
Portsmouth Harbour	Portsmouth BR	52.8%	50.6%
Portsmouth & Southsea		47.2%	49.4%
Southend Central	Southend BR	25.8%	49.1%
Southend East		25.1%	28.0%
Southend Victoria		49.1%	22.9%
Wakefield Kirkgate	Wakefield BR	17.7%	17.5%
Wakefield Westgate		82.3%	82.5%
Worcester Foregate Street	Worcester BR	65.4%	78.8%
Worcester Shrub Hill		34.6%	21.2%

Redistribution of demand around Southend

3.8 At some locations on the rail network, ticket prices are the same for a number of stations in close geographic proximity. An area where this is particularly noticeable is on the southern fork of the Shenfield to Southend branch line. This line links Southend Victoria to Wickford and the Great Eastern Mainline serving the following stations:

- Rayleigh;
- Hockley;
- Rochford;
- Southend Airport;
- Prittlewell; and
- Southend Victoria.

3.9 At these stations the season ticket price to London[3] is the same, therefore London season tickets are generally sold as being from Southend Victoria, regardless of the actual origin station. This means that the ticket sales data shows that there are more people travelling to/from Southend Victoria than is actually the case as there are passengers travelling from Prittlewell with Southend Victoria tickets, for example. In order to account for this, LENNON sales data was used to estimate the number of tickets with Southend Victoria as the origin, but with the issuing office at one of the branch line stations. In these cases, it was assumed that the journey was actually being made from a point on the branch line and not from Southend Victoria.

Example:

If a Southend Victoria to London season ticket was bought at Prittlewell, its journeys are assumed to be from Prittlewell to London.

3.10 A similar process was carried out for journeys from Westcliff to London, where season tickets to London are the same price as from Southend Central and Southend East.

3.11 Table 3.3 shows the season ticket journeys before and after the adjustment. Southend Victoria journeys are redistributed among Prittlewell, Rayleigh, Rochford, Hockley and Southend Airport; Southend East and Southend Central journeys are redistributed to Westcliff only.

Table 3.3 Reallocated Southend to London season journeys in 2014/15 under the old and new methodology

Origin Station	Destination	New Methodology Journeys (2014/15)	Old Methodology Journeys (2014/15)
Southend Victoria	London (ALL)	130,944	1,689,770
Prittlewell	London (ALL)	383,195	56,511
Rayleigh	London (ALL)	270,238	6,997
Rochford	London (ALL)	873,041	173,084
Hockley	London (ALL)	275,511	27,085
Southend Airport	London (ALL)	43,995	23,477
Southend East	London (ALL)	372,199	446,698
Southend Central	London (ALL)	152,261	227,223
Westcliff	London (ALL)	274,576	125,115

[3] For the purposes of the Southend Area redistribution, "London tickets" include seasons to London Terminals and London Travelcards.

Pay As You Go (PAYG)

3.12 In January 2014 a change was made to the way PAYG journeys were recorded in LENNON with non-National Rail origins and destinations recorded as well as National Rail origins and destinations.

3.13 The underlying methodology used to construct the MOIRA2 demand matrix has not been updated to reflect this with the result that PAYG journeys starting or ending at a non-National Rail station have been allocated by default to London BR as their origin or destination in the MOIRA2 demand matrix rather than the station at which they join the National Rail network. For example, a PAYG journey between Canary Wharf and Clapham Junction prior to January 2014 would most likely have been recorded in LENNON as being a journey from Canada Water to Clapham Junction whereas post January 2014 it would be recorded as Canary Wharf to Clapham Junction with the result that in the MOIRA2 demand matrix is recorded as being a London BR to Clapham Junction journey.

3.14 In the 2014/15 statistics we have now included an adjustment process to account for the change in LENNON treatment of PAYG journeys to make the statistics more consistent with previous years. This reduces the number of entries and exits associated with London Terminals and increases entries and exits at key interchange stations. It, however, remains the case that this change in LENNON has affected the last quarter of the 2013/14 statistics and therefore for some interchange stations there is a substantial increase between 2013/14 and 2014/15. The stations where this change has resulted in an increase greater than 10% in 2014/15 are set out in Table 3.4.

Table 3.4: Percentage change in Entries and Exits due to PAYG adjustment

NLC	Station	Percentage change in Entries & Exits due to PAYG adjustment
1659	Canada Water	1091%
7474	West Ham	184%
4935	Whitechapel	175%
598	Harrow-On-The-Hill	121%
8875	West Brompton	117%
7400	Blackhorse Road	109%
1082	Shadwell	53%
6931	Seven Sisters	48%
6009	Highbury & Islington	41%
1457	Willesden Junction	36%
6969	Stratford	32%
3136	Greenford	30%
1553	Kentish Town	30%
3190	Ealing Broadway	27%
1419	Queen's Park (Gt London)	24%
7492	Barking	24%
1421	West Hampstead	19%
9587	Shepherds Bush	19%
5399	Balham	17%

NLC	Station	Percentage change in Entries & Exits due to PAYG adjustment
5081	Brixton	15%
7491	Limehouse	14%
5597	Vauxhall	12%
6953	Walthamstow Central	12%
5146	Greenwich	12%
5301	Clapham High Street	11%
5578	Wimbledon	11%
5152	Woolwich Arsenal	10%
5148	London Bridge	-10%
6965	Liverpool Street	-10%
7490	Fenchurch Street	-19%
577	Farringdon	-22%
6005	Moorgate	-28%
3092	Kensington Olympia	-33%

London Bridge Adjustment

3.15 Engineering work as part of the Thameslink Programme resulted in changes in service patterns to London Bridge in 2014/15. As many tickets 'to London' do not distinguish between specific terminals, the existing methodology for the production of the Station Usage statistics has been to use the proportions implied by the London Area Travel Survey (LATS) to split total journeys between specific terminals. As the LATS data does not account for the ongoing engineering work at London Bridge, an alternative approach was required to enable an adjustment in station entries and exits arising due to changes in journey patterns as a result of the London Bridge works.

3.16 Transport for London's Oyster Clicks Model (OCM) contains historical data of journeys made using Oyster cards, as well as estimates for paper tickets. This data was used to estimate the number of journeys 'to London Bridge' and the number of journeys 'to London Terminals' as a whole in the following process:

1. A list of stations which have journeys to or from London Bridge was created;
2. The OCM data was used to estimate the proportions of journeys that were made to and from London Bridge following the engineering work;
3. The proportions of London Bridge journeys implied by the OCM superceded the proportions implied by LATS; and
4. The residual splits to and from other London Terminals were scaled up or down to account for changes in London Bridge proportions, but held in the same proportion to each other as implied by the LATS data.

Example:

For a given station (Station A), the LATS implies that 25% of Journeys go to London Bridge, 50% to Waterloo East and 25% to Charing Cross. The OCM implies that the new proportion to London Bridge should be 10%. 10% of journeys are therefore assigned to London Bridge, leaving 90% of journeys unassigned. Previously, Waterloo East was assigned 2/3 of non-

London Bridge journeys while Charing Cross was assigned 1/3. The remaining 90% is therefore split between Waterloo East and Charing Cross in this proportion.

Digby & Sowton Adjustment

3.17 Count data provided by the Avocet Line Rail User Group (ALRUG) suggest that the current Station Usage estimates at Digby & Sowton are higher than expected. Additional data from First Great Western suggests that a season ticket product for students is likely a part of the cause of this discrepancy. This is due to a large number of journeys being made to Exeter Central and Exeter St.David's on tickets with a recorded destination of Digby & Sowton. These season journeys have been redistributed to Exeter Central and Exeter St.Davids from Digby & Sowton. Journeys were allocated to Exeter Central and Exeter St. David's according to the proportion of season ticket journeys in the MOIRA2 matrix. The journey adjustment made at these stations is shown in Table 3.5.

Table 3.5 Digby & Sowton Journey Adjustment (2014/15)

Station	Journeys before adjustment (2014/15)	Journeys after adjustment (2014/15)	Percentage change
Digby and Sowton	894,020	571,510	-36%
Exeter Central	2,105,408	2,343,636	+11%
Exeter St. David's	2,424,954	2,509,220	+3%

4 Summary of Results

Overview of the Entries and Exits Results

4.1 The following table gives the total number of entries, exits, and interchanges made over the whole network for 2014/15, compared with the previous year.

Table 4.1 Entries, Exits and Interchanges for 2013/14 – 2014/15

Year	Entries	Exits	Entries & Exits	Interchanges
2013/14	1,332,561,756	1,332,561,756	2,665,123,512	226,191,748
2014/15	1,392,535,310	1,392,535,310	2,785,070,620	230,440,035

4.2 Overall, the increase in entries and exits is 4.5% in 2014/15 compared with the previous year.

4.3 In this section we set out a summary of the overall entries and exits results. The spreadsheet contains entries and exits results for 2,539 stations, compared with 2,537 last year. The table below shows the new stations that have been opened in 2014/15.

Table 4.2 Stations in 2014/15 but not in 2013/14

NLC	Name	Note
1663	Pye Corner	New station located on the Ebbw Valley Line which opened in December 2014.
9507	James Cook University Hospital	New station located on the Esk Valley Line which opened in July 2014.

4.4 Table 4.3 shows data for the ten stations with the highest numbers of entries and exits for 2014/15.

Table 4.3 Top 10 Stations Based on 2014/15 Entries and Exits

Rank This Year	NLC	Station Name	Entries and Exits			Rank Last Year
			2014/15	2013/14	Change	
1	5598	Waterloo	99,201,604	98,442,742	1%	1
2	5426	Victoria	85,337,996	81,356,330	5%	2
3	6965	Liverpool Street	63,631,246	63,004,002	1%	3
4	5148	London Bridge	49,517,854	56,442,044	-12%	4
5	5143	Charing Cross	42,978,890	40,170,074	7%	6
6	1444	Euston	42,952,298	41,911,706	2%	5
7	3087	Paddington	35,724,684	35,093,628	2%	7
8	1127	Birmingham New Street	35,312,788	34,748,984	2%	8
9	6121	King's Cross	31,346,862	29,833,456	5%	9
10	6969	Stratford	30,974,204	26,377,506	17%	12

4.5 The total journeys made at one of the top ten stations account for a total of 517 million journeys, 1.9% more than the 507m journeys made at the top ten stations last year. The top ten stations account for 18.6% of all entries and exits this year, compared with 18.2% in 2013/14. Stratford is now in 10th place, while Leeds has moved from 10th place in 2013/14 to 12th place in 2014/15 - this is partly driven by a methodological change (PAYG methodology) rather than necessarily reflecting real changes in demand. Glasgow Central is the station in 11th place in 2014/15.

4.6 The London Bridge engineering works have resulted in a fall in demand at London Bridge, offset by growth at other London stations such as Charing Cross.

Overview of the Interchanges Results

4.7 In all, around 230.3 million interchanges are estimated to have been made among National Rail operated services (interchanges between rail and tube or other modes are excluded except for cross-London journeys). This is an increase of 1.8% compared to 2013/14 (226.1 million). The ten top stations are listed in the table below.

Table 4.4 Top 10 Stations Based on the Interchanges made for 2014/15

Ranking 2012/13	NLC	Station Name	Interchanges			Ranking 2013/14
			2014/15	2013/14	Change	
1	5595	Clapham Junction	28,425,609	26,846,859	6%	1
2	5598	Waterloo	10,188,921	10,017,069	2%	2
3	5426	Victoria	9,637,566	9,005,162	7%	3
4	5148	London Bridge	8,454,418	8,815,292	-4%	4
5	5355	East Croydon	7,516,092	6,905,570	9%	5
6	1127	Birmingham New Street	5,379,133	5,193,618	4%	6
7	3149	Reading	3,924,743	3,828,202	3%	8
8	1555	St.Pancras	3,887,930	3,504,079	11%	9
9	6121	King's Cross	3,735,773	3,498,734	7%	10
10	1444	Euston	3,534,660	3,474,091	2%	11

4.8 Interchanges occurred at 557 stations in 2014/15 compared to the 542 stations in 2013/14. Stations appearing for the first time in 2014/15 and those stations where no interchanges were recorded this year, but were in the previous year, are listed below.

4.9 Table 4.5 shows the estimated numbers for actual passenger interchanges made during the year.

Table 4.5 Changes in Interchange Stations in 2014/15 vs 2013/14[4]

	Interchanges		Notes
	2014/15	2013/14	
New			
Belper	706	0	
Altrincham	70	0	
Fishguard Harbour	19	0	
Folkestone West	4,444	0	Likely to be related to HS1 services calling at this station
Dorking West	1,639	0	
Thorne South	17	0	
Farnborough North	6,318	0	
Dorchester West	51	0	
Enfield Town	49	0	
Southend East	12	0	
Upper Tyndrum	12	0	
Colchester Town	533	0	
Old			
Pontefract Tanshelf	0	768	

4.10 It is important to note that interchanges can change significantly from year to year for a variety of reasons. Factors such as new service patterns and changes in journey times play a part. The number of interchanges is based on the rail industry ORCATS model, which predicts passenger choices of rail route and trains used. Refer to Appendix C for more information on the ORCATS allocation process.

[4] Only showing stations with 10 or more interchanges.

5 Validation

Introduction

5.1 Checks undertaken on the Station Usage dataset encompass a number of elements, including:

- Investigation of large increases and decreases for individual stations;
- Checks at different geographical levels; and
- Validation against alternative data sources.

It is important that the validation and comparisons made in this chapter are set in the context of the changes in the methodology for 2014/15. This will impact on direct comparison of levels of usage at stations in these areas between 2013/14 and previous years as set out in these ORR statistics. This is particularly relevant for the Tyne & Wear and London areas where significant increases or decreases in usage in 2014/15 are not necessarily indicative of underlying growth or decline in actual usage but a direct result of the methodological changes described in Chapter 3.

Data Checks

Large increases and decreases

5.2 Table 5.1 shows the 10 stations with the largest proportional increases in total flow for stations with more than 10,000 entries and exits. There are a variety of reasons for the largest changes between 2013/14 and 2014/15, which include both endogenous (changes to the methodology) and exogenous factors.

Table 5.1 Top 10 Increases in 2014/15

NLC	Station Name	Entries and Exits			Reason
		2014/15	2013/14	Increase (%)	
375	Energlyn & Churchill Park	69,390	15,938	335%	Significant increase in demand that would be expected for new station open in December 2013
5462	Pevensey Bay	25,464	6,838	272%	Likely related to tourist traffic
7165	Manea	10,794	3,694	192%	Received improved service from Jan 2014
7419	Prittlewell	424,804	163,802	159%	**Methodological change:** Improved distribution of branch line season tickets relating to Southend.
7503	Blaydon	11,880	5,014	137%	Timetable improvement
6498	Newark Castle	538,503	240,454	124%	**Methodological change:** Improved allocation of demand between Newark BR group stations based on new count data
3346	Melksham	51,858	23,930	117%	Significant timetable improvement in Dec 2013, continued ramp-up
9790	Dalmarnock	217,120	100,360	116%	High Growth trend, possibly due to station refurbishment
1386	Stewartby	32,330	16,012	102%	Opening of Kimberley College in September, 2013 - more pupils in 2014-15
7953	South Bank	22,860	12,544	82%	High Growth Trend

5.3 Table 5.2 shows the 10 stations with the largest proportional decreases in total entries and exists for stations with more than 10,000 entries and exits.

5.4 As with the large increases, there are a variety of endogenous and exogenous reasons for large decreases.

Table 5.2 Top 10 Decreases in 2014/15

NLC	Station Name	Entries and Exits			Reason
		2014/15	2013/14	Decrease (%)	
7420	Southend Victoria	1,358,773	3,726,876	-64%	**Methodological change:** Improved distribution of branch line season tickets and Count-based distribution at Southend BR stations
3104	Bicester Town	88,440	207,900	-57%	Station closed February 2014 to allow reinstatement and upgrade of Oxford - Marylebone line. Renamed Bicester Village
3961	Garth (Mid-Glamorgan)	14,810	26,292	-44%	Maesteg Line - spike in demand in 2013/14, has now returned to close to 2012/13 levels
7640	Sunderland	465,784	793,418	-41%	**Methodological change:** New PTE Infill for Tyne & Wear
4891	Worcester Shrub Hill	595,402	968,834	-39%	**Methodological change:** Improved BR proportions from new count data
3160	Reading West	385,332	610,814	-37%	Possible reversal of demand back to Reading following redevelopment work
9544	Prestwick Internat'nl Airport	293,888	453,998	-35%	Likely linked to decline in number of flights from Glasgow Prestwick Airport
2973	Moston	82,486	125,902	-34%	Reduced service since the May 2014 timetable introduced
1561	Park Street	20,944	31,734	-34%	Abbey Line closed Nov-Dec 2014 for Watford upgrades
9618	IBM Halt	47,376	71,128	-33%	Demand decrease trend

5.5 As in the 2013/14 dataset two flags have been included in the published dataset identifying:

- Stations with more than 10,000 entries and exits a year where entries and exits have increased or decreased by more than 10%; and
- Stations with less than 10,000 entries and exits a year where entries and exits have increased or decreased by more than 25%.

5.6 These flags have been used to identify stations where further investigation should be carried out to ensure, where possible, the reported changes reflect reality. The limits set are demanding (10% of 10,000, for example could represent just two extra season ticket holders per year) and investigations have been focussed on the most significant changes but where obvious explanations for less significant changes are available these have been included in the Station Usage dataset. In total 515 stations were captured by one of the two flags.

5.7 Whilst reasons for large changes at some stations are specific to that station, in many instances there are groups of stations where there is a common cause for the changes seen. In 2014/15 we have identified a number of reasons that affect multiple stations. These are shown in Table 5.3. The largest causes of change are due to timetable changes, engineering work and the change in the Oyster PAYG methodology.

Table 5.3 Summary of identified reasons for large changes

Reason	Description	Methodological Change
Timetable change, including: • Glasgow area • West Highland Line	Changes to timetables that are likely to have impacted service levels and hence demand at affected stations.	
Major engineering work, including: • Abbey Line upgrade • London Bridge (Thameslink programme) • Oxford-Bicester upgrade	Includes: • Line closures during 2014/15 that have led to a lower level of demand. • Recovery from line closures in 2013/14.	
PAYG Issue	See section "Pay As You Go (PAYG)" of this report	✓
Tourist Traffic	Stations associated with tourist/seasonal demand which can vary from year to year.	
Improved proportions from count data, including: • Edenbridge Stations • Falkirk Stations • Newark Stations • Worcester Stations	See section "Count-based redistribution of demand at Group Stations" of this report	✓
East London Line growth	Strong growth at stations on the East London Line due to continued demand growth on London Overground.	
Southend re-distribution	See section "Redistribution of demand around Southend"	✓
Service recovery from events during 2013/14, including: • Winter Storms • Nottingham re-signalling • Hatfield Colliery Landslip	Recovery from Winter Storms in 2013/14 including the reopening of the line through Dawlish and the reopening of the Cambrian Coast line.	
Event traffic	Specific events, e.g. sports, that can lead to significant variations in demand from year to year. For example, hosting the Open Golf Championship near to Hoylake station.	
HS1-related demand changes	Demand change linked to provision of HS1 services – for example through improved provision of domestic 'Javelin' services.	
Mode transfer	Transfer to other transport modes, for example switching to using light rail.	
Other exogenous growth • Nearby developments • Airport traffic	Demand change linked to non-railway factors, for example new sources of employment. Also includes changes due to airport demand.	

Reason	Description	Methodological Change
New stations • Stations opened in 2014/15 • Stations opened in previous years • Refurbishment of stations	Demand change associated with a new station being opened in this year (see Table 4.2) and demand growth at stations opened in previous years. Also includes demand growth that could be related to improved station facilities making travel more attractive.	
Digby & Sowton Issue	See section "Digby & Sowton Adjustment" of this report	✓
Improved PTE Infill for Tyne & Wear PTE	See section "Tyne & Wear PTE Infill" of this report	✓

Checks at different geographical levels

5.8 It is possible that in certain areas changes at the individual station level might not be large enough to be flagged but as a group the results might be unexpected. For this reason we have carried out some checks at a number of levels of detail. In this section we summarise the station count data for the following aggregations of data:

- London Travelcard/PTE area;
- Government Office Region (GOR); and
- Station Facility Owner (SFO).

Table 5.4 Entries and Exits by PTE and London Travelcard Area

PTE	Entries and Exits		Change (%)	Impacted by methodological change
	2014/15	2013/14		
London Travelcard Area	1,384,498,590	1,312,274,060	5.5%	
Greater Manchester	72,390,080	72,891,624	-0.7%	Lower level of demand in GMPTE infill
Merseyside	95,974,922	92,979,376	3.2%	
South Yorkshire	20,532,454	18,991,968	8.1%	
Strathclyde	121,854,816	114,845,022	6.1%	
Tyne & Wear	9,033,056	9,469,844	-4.6%	New Tyne & Wear PTE Infill
West Midlands	98,235,056	95,847,842	2.5%	
West Yorkshire	69,707,862	67,156,938	3.8%	

5.9 This table shows reasonable increases for all PTEs except Greater Manchester and Tyne & Wear. The Greater Manchester PTE infill was smaller in 2014/15 due to restrictions being put in place for certain PTE products. While causing increases in demand at a number of stations, the new Tyne & Wear infill results in a lower level of estimated usage at Newcastle and Sunderland, leading to an overall decrease in the Tyne & Wear PTE area.

Table 5.5 Entries and Exits by Government Office Region

GOR	Entries and Exits		Change (%)	Impacted by methodological change
	2014/15	2013/14		
London	1,370,193,312	1,298,803,130	5.5%	
South East	381,209,368	369,776,966	3.1%	
East	204,183,830	195,856,432	4.3%	
South West	74,278,294	70,895,274	4.8%	
East Midlands	41,177,784	38,950,710	5.7%	
West Midlands	132,420,618	129,261,806	2.4%	
North East	20,684,452	20,954,860	-1.3%	New Tyne & Wear PTE Infill
North West	215,430,852	211,171,750	2.0%	
Yorkshire And The Humber	112,724,818	107,733,366	4.6%	
Wales – Cymru	49,294,944	48,633,988	1.4%	
Scotland	183,472,348	173,364,650	5.8%	

5.10 Growth across Government Office Regions (GORs) appears reasonable. The new Tyne & Wear infill results in a lower level of usage than estimated in previous years which reduces the apparent increase in the North East GOR.

Table 5.6 Entries and Exits by Station Facility Owner

SFO	Entries and Exits		Change (%)
	2014/15	2013/14	
TOCs			
Abellio Greater Anglia	196,841,007	183,686,595	7.2%
Arriva Trains Wales	59,184,440	57,891,788	2%
c2c	55,373,277	50,205,816	10.3%
Chiltern Railways	44,304,434	42,520,846	4%
East Midlands Trains	42,340,841	39,511,470	7%
First Great Western	106,715,702	102,192,680	4%
First TransPennine Express	24,431,032	23,714,008	3%
Govia Thameslink Railway	134,670,514	127,342,797	6%
London Midland Trains	82,540,045	80,549,834	2%
London Overground	143,017,950	133,638,392	7%
Merseyrail	77,977,626	75,337,514	4%
Northern Rail	118,360,974	116,922,674	1%
ScotRail	132,681,208	125,345,546	6%
South West Trains	293,017,736	282,519,630	4%
South West Trains (Island Line)	1,305,588	1,401,600	-7%
Southeastern	203,641,768	192,405,844	6%
Southern	197,015,276	191,116,123	3%
Virgin Trains West Coast	42,814,708	41,240,674	4%

SFO	Entries and Exits		Change (%)
Virgin Trains East Coast	35,843,962	34,999,285	2%
Non-TOCs			
Glasgow Prestwick Airport	293,888	453,998	-35%
London Underground	75,865,622	61,025,284	24%
Network Rail	716,312,289	700,972,105	2%
Stobart Rail	520,734	408,430	27%

5.11 Changes at the SFO level are generally within reasonable bounds, though there are some large changes to highlight. The large increase in usage at London Underground stations is likely due to the change in PAYG methodology described in Chapter 3. There is a large percentage decrease in usage at Glasgow Prestwick Airport which is likely linked to the number of flights operating from the airport. Strong growth for Stobart Rail (Southend Airport) follows ramp-up demand growth in previous years, as well as the methodological adjustment for Southend Victoria branch season tickets. There is an ongoing decrease in usage on South West Trains (Island Line) which is consistent with the trend in previous years.

Validation against alternative data sources

Comparison with ORR journey data on the ORR data portal

5.12 The ORR produces journey data by sector and TOC and makes this available on the ORR website via its data portal and as a National Statistics release[5]. Growth from 2013/14 to 2014/15 from this data was 4.2% at the national level for franchised TOCs. The Station Usage dataset shows an increase of 4.5% over the same period, within the expected level of variation from the ORR data.

Comparison with PIXC data

5.13 The DfT collects count data for major cities throughout the UK. The method of collection means that for through stations it is often not possible to calculate boarders and alighters but for terminal stations this is usually possible. Using data provided by the DfT we have compared growth rates at the major London termini covered by the count data with those seen in the calculated Station Usage dataset.

[5] Formerly this formed part of the National Rail Trends publication

Table 5.7 Comparison of Station Usage and PiXC Growth Rates 2013/14 – 2014/15

Station	Station Usage growth rate	PiXC growth rate
Euston	2.5%	4.2%
Fenchurch Street	-3.5%	4.9%
King's Cross	5.1%	2.7%
Liverpool Street	1.0%	3.9%
Marylebone	2.9%	3.9%
Moorgate	3.8%	8.0%
Paddington	1.8%	10.1%
Victoria	4.9%	1.9%
Waterloo	0.8%	4.6%

Source: PiXC data from: **https://www.gov.uk/government/statistics/rail-passenger-numbers-and-crowding-on-weekdays-in-major-cities-in-england-and-wales-2014**

5.14 While broadly similar, there are some notable differences between the PiXC growth rates and the Station Usage dataset. The adjustment to the Oyster PAYG methodology is likely to be partly responsible for this discrepancy. Additionally, the PiXC counts are weekday only therefore they won't capture weekend variations. They also represent growth for a particular time of year and will not reflect changing demand conditions over the year.

steer davies gleave

A Appendix – Historical Methodological Changes

Historical Methodological Changes

A.1 A series of methodological improvements have been made to the Station Usage dataset since 2006/07 and the improvements made to the ODM and Station Usage methodology are described in the section. This appendix is divided into two sections:

- **Methodology changes prior to 2011/12:** These changes were implemented by DeltaRail who were the consultants working for the ORR to produce the statistics prior to 2011/12.
- **Methodology changes from 2011/12:** These changes are those that have been specified and implemented by Steer Davies Gleave.

Methodology changes prior to 2011/12

It should be noted that the information in this section has been reproduced from previous reports on the Station Usage statistics produced by DeltaRail.

A.2 Between 2006/07 and 2008/09 the accuracy and usefulness of the ODM was improved by applying new procedures on the way journeys with unknown origin and/or destination have been treated, and by including journeys that were previously excluded from the file or did not appear in the LENNON sales data. In summary, the main changes were:

- Adding in previously missing journeys, e.g. TfL sold Travelcards, and some airport link tickets - this is undertaken in the production of the MOIRA2 demand matrix.
- Rail Links such as PlusBus and Attractions. The rail element of these ticket sales is now included - this is undertaken in the production of the MOIRA2 demand matrix.
- Estimating the split of records for station groups, including London BR, into the constituent individual stations. This methodology was further refined for those groups with no ticket office at one or more stations within the group - this processing is undertaken in the ODM,
- Via the integration with the process that creates the MOIRA2 Demand Matrix, PTE ticket sales are now included, in addition to TfL sold Travelcards, and some airport link tickets – this is undertaken in the production of the MOIRA2 demand matrix.
- The method for estimating passenger journeys from ticket sales has changed. This is a result of using the MOIRA2 Demand Matrix as a starting point. The MOIRA2 Demand Matrix does not disaggregate single journeys, and so when estimating passenger journeys all ticket sales have been split equally into the two directions of travel. This will only have an impact on the ODM if there is more travel on single tickets away from a station compared to travel to the station, which is not likely to be material. Therefore in the Station Usage file, entries are the same as exits.

A.3 In 2009/10 further improvements were made:

- Adding in data for journeys undertaken by Oyster "pay-as-you-go" (PAYG) in the London area. This is undertaken within the base LENNON data, in the production of the MOIRA2 demand matrix. This applies to journeys made after 1 January 2010.
- Refinement of the methodology used to calculate journeys undertaken using PTE tickets.

A.4 When the 2010/11 dataset was constructed it emerged that the original 2008/09 figures which were given for one PTE, West Yorkshire, were not a complete record of all the rail journeys on multimodal tickets which should have been included in the PTE infill. A correction was therefore made by uplifting the West Yorkshire PTE Infill, both revenue and journeys figures, by 53% on top of the generic PTE infill growth rate. Note that within West Yorkshire PTE area, the majority of rail journeys are made on rail-only tickets, i.e. not PTE Infill tickets. Thus the overall effect of this correction was relatively small.

Oyster PAYG

A.5 Oyster 'Pay As You Go' (PAYG) was rolled out at National Rail stations in January 2010. Prior to this date Oyster PAYG was available on selected routes only and was not recorded (in LENNON) on a flow or station basis. After this date Oyster PAYG was available at all National Rail stations in the Travelcard Area are recorded by flow.

A.6 The 2009/10 data contained roughly 9 months of data prior to January 2010 and 3 months of data after, while the 2010/11 data which was wholly after January 2010 when Oyster PAYG, with data capture, had been fully implemented contains a full year of data. This lead to some very large reported growth figures for some stations within the London Travelcard (/Oyster PAYG) area. The 2010/11 figures, based on recorded use of Oyster PAYG should be accurate, but the percentage growth may be over-represented since the old figures would be largely estimates made without the benefit of Oyster records.

Methodological changes from 2011/12

This section summarises the methodological changes specified and implemented in the Station Usage dataset by Steer Davies Gleave in the 2011/12, 2012/13 and 2013/14 datasets. The descriptions of the methodological changes in this section were originally included in the Station Usage Methodology and Validation reports for those years' datasets. The methodological changes implemented in 2014/15 are described in Chapter 3 of this report.

Methodological Changes in 2011/12

Improved PTE Infill growth rate

A.7 With the initial version of MOIRA2 an improved representation of PTE demand was included in the base demand matrix based on work undertaken by Steer Davies Gleave for the year 2008/09. This included journeys from tickets sold at non-railway sales points and an estimated distribution of journeys largely based on the distribution of point to point tickets sold in PTE areas.

A.8 Subsequent versions of the MOIRA2 demand matrix have included a PTE infill but the journeys are now based directly on LENNON data and are therefore not consistent with the 2008/09 infill.

A.9 To maintain consistency with previous ORR statistics the PTE infill contained in the ODM was therefore based on the 2008/09 MOIRA2 PTE infill grown by growth rates derived from National Rail Trends data.

A.10 Up until 2010/11 the application of growth was carried out at a highly aggregate level based on growth seen for 'franchised regional operators' as reported in National Rail Trends data. In the construction of the 2011/12 dataset a more disaggregate set of growth rates were applied at the PTE level based on LENNON data to improve the appropriateness of the growth rates applied and reflect geographical variations in demand growth.

Inclusion of revised West Midlands PTE (Centro) Infill

A.11 Steer Davies Gleave were commissioned in 2011 by the Passenger Demand Forecasting Council (PDFC) to construct a PTE infill matrix for the Centro area for the rail year 2010/11. The methodology followed that used for the construction of the original MOIRA2 infill but included use of additional data sources and specific adjustments for known issues such as directionality.

A.12 This infill represented a significant improvement on the infill in the ODM and therefore as part of the 2011/12 update the PDFC infill was updated to 2011/12 data and included in the ODM and hence the Station Usage dataset.

A.13 The inclusion of the Centro infill represented a significant change for stations within the Centro area and also a number of stations not in the Centro area but where Centro tickets can be purchased for travel into the Centro area. For the majority of stations the inclusion of the infill resulted in an increase in entries and exits although in a small number of instances there was a decrease. A comparison of the 2011/12 Centro infill with the 2010/11 ODM infill is included in Table A.1. This shows that the new infill added approximately 5 million journeys (10 million entries and exits) compared to what would have been derived had the previous methodology been used.

Table A.1: Centro area infill comparison

	2010/11 ODM infill	2010/11 infill grown to 2011/12 using previous methodology	2011/12 updated infill
Journeys (m)	15.5	16.6	21.3

New 'Other' infill layer

A.14 In some non-PTE areas there are zonal products which are not captured within the MOIRA2 demand matrix (e.g. Rover and Ranger products). Whilst volumes of travel on these tickets are relatively small, in the area of use they can be significant. Therefore, in the 2011/12 update we included journey estimates for a number of Rover and Ranger products. These were:

- St Ives Group Day Ranger;
- St Ives Day Ranger;
- St Ives Family Day Ranger;
- Valleys Night Rider; and
- Cambrian Coaster Ranger.

A.15 Journeys on these products were included as an 'Other' infill in the ODM, together with journeys from some non-LENNON season ticket products previously included in the airport flow infill. Journey estimates for these products were constructed using LENNON data and distributing journeys based on point of sale and the underlying reduced ticket travel distribution of the stations covered.

A.16 The total number of entries and exits arising from inclusion of these journeys was 760k. Table A.2 lists the top five stations impacted most significantly:

Table A.2: Top five stations impacted by inclusion of the 'Other' infill

NLC	Station Name	2010/11 entries and exits	2011/12 entries and exits	Reason
3538	St.Ives	258,530	578,214	Inclusion of St Ives branch line rover products
3542	Carbis Bay	55,334	206,736	
3537	St.Erth	120,770	202,362	
3498	Lelant Saltings	17,224	101,284	
3899	Cardiff Central	11,259,968	11,502,080	Inclusion of Valley Night Rider product

Calibration of entries and exits to count data at group stations (pilot)

A.17 A key addition to the underlying MOIRA2 data in the construction of the Station Usage dataset is the breakdown of group station flows into their component stations. This is a significant task and based primarily on sales location data which is becoming less robust as increasing volumes of sales are completed via the internet.

A.18 For the purposes of the 2011/12 dataset a pilot was conducted for stations within the Liverpool BR group of stations, using count data to allocate journeys between the stations. The stations that this impacted were:

- Liverpool Lime Street;
- Liverpool Central;
- Liverpool James Street; and
- Moorfields.

A.19 Count data sourced from the DfT and Merseytravel enabled the calculation of the split of demand between the central Liverpool stations as shown in Table A.3. These percentages were then used to divide total central Liverpool demand, as calculated by the Station Usage process, between the central Liverpool stations. The same splits were applied across all ticket types.

Table A.3: Modification of central Liverpool Station Usage data

Station	2011/12 Entries and Exits old methodology	Implied split between stations	Implied split between stations from counts	Adjusted Liverpool station entries and exits
Liverpool Lime Street	11,882,144	32%	37%	13,835,314
Liverpool Central	17,497,878	47%	38%	14,209,241
Liverpool James Street	3,524,654	9%	8%	2,991,419
Moorfields	4,488,064	12%	17%	6,356,766

Methodological Changes in 2012/13

Improved Greater Manchester and West Yorkshire PTE Infill

A.20 Building on the inclusion in the 2011/12 dataset of an improved infill for the Centro area, an improved PTE infill was included in the 2012/13 dataset for two of the remaining PTEs – West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TFGM). This was produced using a process derived to construct infill demand for the Rail in the North demand and revenue model produced by Mott MacDonald and MVA for the Rail in the North (RiN) consortium and was supplied by Mott MacDonald.

A.21 The impact of the methodological change at the PTE level is shown in Table A.4.

Table A.4: West Yorkshire and Greater Manchester PTE Infill (2012/13)

PTE	Journeys (m)	
	Old Methodology	New Methodology
West Yorkshire PTE	6.83	8.67
Greater Manchester PTE	5.05	5.10

***Source**: SDG Analysis of PTE infill based on a station classification into PTEs – this necessitates a simplified treatment of cross-PTE boundary flows*

A.22 The new infill had a significant impact at the total level for the West Yorkshire PTE area with a 27% increase in the number of journeys on West Yorkshire PTE tickets. The impact on the total size of the GMPTE infill was much smaller but there were still significant distributional impacts as demonstrated by the presence of a number of GMPTE stations in the top ten changes from the improved infill as shown in Appendix Table A.5.

Table A.5: Top Ten Changes (in absolute terms) in Entries and Exits with Inclusion of New PTE Infill for GMPTE and WYPTE (2012/13)

Station	Entries and Exits (with old infill)	Entries and Exits (with new infill)	Change in Entries and Exits (%)
Leeds	24,450,682	26,200,916	7%
Huddersfield	4,022,672	4,656,700	16%
Manchester Airport	3,414,466	3,136,816	-8%
Bolton	3,313,742	3,583,392	8%
Bradford Interchange	2,782,466	3,004,718	8%
Dewsbury	1,389,050	1,603,702	15%
Manchester Piccadilly	23,358,295	23,158,477	-1%
Guiseley	945,722	1,134,560	20%
Shipley	1,497,954	1,666,542	11%
Castleford	413,318	537,898	30%

Calibration of entries and exits to count data at group stations

A.23 The key addition to the underlying MOIRA2 data in the construction of the Station Usage dataset is the breakdown of group station flows into their component stations. This is a significant task and the existing methodology based primarily on sales data is becoming less robust as increasing volumes of sales are completed via the internet.

A.24 For the purposes of the 2012/13 dataset we therefore undertook a significant programme of counts at a number of stations to provide a basis for allocating demand at the station group level between these stations.

A.25 In the application of the count data consistency with the underlying ODM data was maintained by controlling total entries and exits at the station group level to the total station group demand in the underlying matrix. Count data was then used to apportion the total station group demand between the individual stations. It is important to emphasise this point – the count data was only used to distribute demand between stations within each of the relevant station groups, it was not used to set the overall level of demand. Use of count data to set the total level of entries and exits by station was not implemented for a number of reasons, including:

- Consistency with underlying data in the ODM matrix;
- Seasonal variation in demand would need to be accounted for on a robust basis; and
- Counts would need to be undertaken in succeeding years and on a sufficiently robust basis to ensure random variation between years was minimal.

A.26 Following the counts a thorough process of validation was completed, utilising, where possible, information and data provided by Train Operators to corroborate the count data. On completion of the validation it was agreed with the ORR that the outputs of the count data would be used to allocate demand between stations for the stations listed in Appendix Table A.6. This table also shows the distribution of entries and exits between the stations with the previous and new methodology. The dominant trend in the changes is an increase in

demand at the smaller (and often ticket office-less) stations at the expense of the larger stations in the group.

Table A.6: Stations Impacted by use of Count Data to Distribute Demand Between Group Stations (2012/13)

Group	Station	Entries and Exits		
		Previous methodology	New methodology	Change (%)
Farnborough BR	Farnborough (Main)	3,149,316	2,859,700	-9%
	Farnborough North	328,684	618,300	88%
Bedford BR	Bedford Midland	3,448,926	3,303,270	-4%
	Bedford St.Johns	9,320	154,976	1563%
Wakefield BR	Wakefield Westgate	2,240,342	2,266,915	1%
	Wakefield Kirkgate	514,862	488,289	-5%
Maidstone BR	Maidstone East	1,796,012	1,343,900	-25%
	Maidstone West	529,796	834,293	57%
	Maidstone Barracks	120,150	267,765	123%
Dorking BR	Deepdene	389,786	454,909	17%
	Dorking	1,354,864	1,234,007	-9%
	Dorking West	40	55,774	139435%
Newark BR	Newark North Gate	1,096,442	1,179,491	8%
	Newark Castle	320,558	237,509	-26%
Dorchester BR	Dorchester South	533,304	469,294	-12%
	Dorchester West	66,828	130,838	96%
Colchester BR	Colchester	4,574,692	4,291,055	-6%
	Colchester Town	459,380	743,017	62%
Portsmouth BR	Portsmouth & Southsea	2,352,460	1,965,324	-16%
	Portsmouth Harbour	1,809,936	2,197,072	21%
Hertford BR	Hertford North	1,342,800	1,338,227	0%
	Hertford East	769,974	774,547	1%

Inclusion of Freedom Pass journeys in PTE Infill

A.27 The TfL concessionary product the 'Freedom Pass' is included in the Oyster system. However, unlike paid-for Oyster products, travel on the Freedom Pass was not included in the Station Usage estimates prior to 2012/13. Given the volume of rail travel on the Freedom Pass (circa 21 million entries and exits in 2012/13) inclusion of these journeys where possible in the Station Usage dataset was highly desirable.

A.28 To facilitate the inclusion of Freedom Pass journeys TfL provided the following data to enable an estimate of Freedom Pass journeys on the rail network:

- Total journeys on Freedom Pass with touch in/out at least one end of the journey at a 'NR subsystem'[6] station for each period in the 2012/13 year
- Origin and destination breakdown of Freedom Pass journeys where the passenger touched in or out for period 4 of 2012/13 (July 2012), including a distinction between London Underground and National Rail services e.g. entries and exits at London Bridge National Rail and London Bridge London Undergound are recorded separately

A.29 Inclusion of the Freedom Pass journeys was then achieved through a two-stage process:

- Calculation of period 4 Freedom Pass journeys on National Rail/London Overground services by assigning each origin destination in the sample period 4 data as being either a National Rail/London Overground journey or not. This was required to exclude journeys not on the National Rail/London Overground network.
- Estimation of total 2012/13 Freedom Pass journeys on National Rail/London Overground by flow by using the periodic 'NR subsystem' data to inform an expansion of the period 4 journeys.

A.30 The number of Freedom Pass journeys included was necessarily a conservative estimate since it does not capture journeys where the passenger did not have to touch in or out. In addition, the smallest flows in the period 4 dataset were not being included since it was not practical to categorise every single flow.

A.31 Appendix Table A.7 shows the top ten increases in Station Usage from the inclusion of Freedom Pass journeys. This shows that the numbers of Freedom Pass journeys are sufficient to have a significant impact at even relatively heavily used stations such as West Croydon.

Table A.7: Top Ten Changes (in absolute terms) in Station Usage from Inclusion of Freedom Pass Data

Station	Entries and Exits		
	Without Freedom Pass	With Freedom Pass	Change (%)
Victoria	75,884,234	77,346,676	1.9%
Waterloo	94,673,486	95,936,542	1.3%
London Bridge	52,342,710	53,351,116	1.9%
East Croydon	20,060,778	20,965,248	4.5%
Clapham Junction	22,916,064	23,622,718	3.1%
Liverpool Street	57,856,458	58,448,814	1.0%
Charing Cross	38,140,698	38,607,238	1.2%
Stratford	25,129,740	25,564,250	1.7%
Wimbledon	18,475,254	18,902,016	2.3%
West Croydon	3,880,666	4,300,582	10.8%

[6] The NR subsystem is a set of stations which is used for recording purposes by TfL. It is composed primarily of National Rail stations but does include some joint stations (e.g. Wimbledon). As such it could not be used to provide a completely clean estimate of total National Rail Freedom Pass journeys but the periodic data was informative when scaling the detailed Period 4 data to the whole year.

Additions to the 'Other' infill layer

A.32 In 2011/12 a number of zonal products outside PTE areas and not captured within the MOIRA2 demand matrix were included for the first time in the dataset as part of a new 'Other' infill layer. In the 2012/13 dataset a further five non-PTE zonal products were included. The products included were:

- Anglia Plus;
- Devon Evening Ranger;
- Devon Day Ranger;
- Ride Cornwall; and
- Freedom Travel Pass (West of England product).

A.33 Journey estimates for these products were constructed using LENNON data and distributing journeys based on point of sale and the underlying reduced[7] ticket travel distribution of the stations covered.

A.34 The total number of entries and exits arising from inclusion of these journeys is 1.05m. Appendix A.8 lists the top ten stations impacted most significantly:

Table A.8: Top Ten Stations Impacted by Inclusion of the 'Other' Products

Station Name	Entries and Exits		Change (%)	Reason
	Without "Other" Products	With "Other" Products		
Norwich	3,949,610	4,126,012	4.5%	Inclusion of Anglia Plus products
Ipswich	3,202,062	3,348,394	4.6%	
Cambridge	9,080,762	9,168,936	1.0%	
Bury St.Edmunds	501,966	566,110	12.8%	
Plymouth	2,530,000	2,579,316	1.9%	Inclusion of Devon/Cornwall Rangers
Lowestoft	411,536	459,166	11.6%	Inclusion of Anglia Plus products
Exeter St. David's	2,361,172	2,401,276	1.7%	Inclusion of Devon Rangers
Stowmarket	897,376	927,856	3.4%	Inclusion of Anglia Plus products
Thetford	264,318	287,024	8.6%	
Bristol Temple Meads	9,076,954	9,099,332	0.2%	Inclusion of Freedom Travel Pass products

Methodological Changes in 2013/14

Improved South Yorkshire PTE Infill

A.35 Building on the inclusion in the 2012/13 dataset of an improved infill for the West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TfGM) PTE areas, an improved infill for the South

[7] With the exception of the Anglia Plus product which has both Reduced and Season variants. For the Season variants of this product the underlying Full ticket travel distribution of the stations covered was used given that the coverage of Season tickets in the base matrix was limited.

Yorkshire (SYPTE) PTE area was included in the 2013/14 dataset. This was produced using a process derived to construct infill demand for the Rail in the North (RiN) demand and revenue model produced by Mott MacDonald and MVA for the RiN consortium and was supplied by Mott MacDonald. This is consistent with the methodology underlying the improved West Yorkshire (WYPTE) and Greater Manchester (GMPTE/TfGM) infills. At the total PTE level the impact of the new infill was to reduce demand by 1.3m. However, there was also a significant distributional impact as can be seen in Appendix Table A.9, which shows the top ten largest changes as a result of the new South Yorkshire infill.

Table A.9: Top Ten Changes (in absolute terms) in Entries and Exits with Inclusion of new SYPTE PTE Infill (2013/14)[8]

Station	Change in entries and exits with new infill	% Change
Doncaster	-497,139	-13%
Sheffield	-256,998	-3%
Barnsley	-150,784	-10%
Mexborough	-104,966	-34%
Rotherham Central	-69,654	-9%
Adwick	-57,110	-24%
Wombwell	+49,918	+30%
Bentley (South Yorkshire)	-47,014	-28%
Kirk Sandall	-45,582	-32%
Swinton (South Yorkshire)	-45,086	-11%

Improved Merseyside PTE Infill

A.36 Prior to 2013/14 the infill for the Merseyside area was derived from the generic PTE infill produced as part of the MOIRA2 Replacement project which was based on a 2008/09 base year. To produce updated estimates in succeeding years, the distribution of demand in the infill matrix was maintained and the total volume of demand grown, initially by the journey growth shown by the Regional Sector in the ORR's rail usage data and, since 2011/12, by the growth in journeys (from LENNON) on service codes associated with the Merseyside area.

A.37 Since 2008/09 there have been a number of developments which mean that the 2008/09 distribution is inappropriate. Of particular importance has been a movement away from RSP products to PTE products on some routes on the edges of the Merseytravel area (e.g Town Green, Aughton Park and Ormskirk on the Northern line) which means that the existing distribution underestimates demand in these areas.

A.38 Recognising the deficiencies of the existing infill, a new infill was produced by Mott MacDonald building on the PTE infill in the Liverpool City Region Model (LCRM) produced for Merseytravel. Unlike the other PTE infills, journeys in the Merseyside infill have been scaled

[8] As all the new Mott MacDonald infills were incorporated into the ODM at the same time, it is not possible to definitively isolate each infill. For the purposes of this exercise, stations within the Yorkshire and Humber Government Office Region were considered to be those affected by the new SYPTE infill.

to count data at an aggregate level across all affected stations where complete counts are available to ensure a robust match with 'reality'. This is possible since count data in the Merseyside area is more extensive and comprehensive across stations than in other areas.

A.39 The inclusion of the new infill increased entries and exits by 10.8m (5.1% of total North West entries and exits). Appendix Table A.10 shows the top ten changes in entries and exits by station. Some of the largest changes are outside the Merseytravel area (e.g. Chester) and this is because some Merseytravel products can be used outside the core Merseytravel area.

Table A.10: Top Ten Changes (in absolute terms) in Entries and Exits with inclusion of new Merseyside PTE Infill (2013/14)[9]

Station	Change in entries and exits with new infill	% Change
Southport	+ 1,452,670	+ 57%
Ormskirk	+ 1,302,182	+ 172%
Chester	+ 1,204,048	+ 39%
Liverpool South Parkway	+ 1,025,900	+ 135%
Waterloo (Merseyside)	+ 1,005,970	+ 214%
Liverpool Central	+ 898,367	+ 7%
Liverpool Lime Street	+ 874,711	+ 7%
West Kirby	+ 851,062	+ 314%
Sandhills	+ 768,598	+ 160%
Kirkby (Merseyside)	+ 553,690	+ 31%

Improved Strathclyde Passenger Transport (SPT) infill

A.40 A more sophisticated infill was developed by Mott MacDonald to capture demand in the Strathclyde area on a number of SPT products, namely:

- Zonecard;
- Roundabout; and
- Daytripper

A.41 Total sales data for these tickets was obtained from a combination of LENNON data and off rail sales figures from SPT. The number of journeys on each ticket type was established by applying appropriate tip rate proxies for each type. The data was distributed using Zonecard forum travel diary data and LENNON station-station reduced ticket proportions to produce an estimate of station-to-station movements. The new infill resulted in a drop in entries and exits of approximately 4.4m (2.5% of total Scotland entries and exits). The top ten changes by station are shown in Appendix Table A.11.

[9] As all the new Mott MacDonald infills were incorporated into the ODM at the same time, it is not possible to definitively isolate each infill. For the purposes of this exercise, stations within the North West Government Office Region were considered to be those affected by the new Merseyside infill.

Table A.11: Top Ten Changes (in absolute terms) in Entries and Exits with inclusion of new Strathclyde Infill (2013/14)[10]

Station	Change in entries and exits with new infill	% Change
Glasgow Central	-1,254,874	-4%
Glasgow Queen Street	-1,025,052	-6%
Helensburgh Central	-391,278	-32%
Motherwell	-232,668	-17%
Charing Cross (Glasgow)	-154,791	-8%
Kilwinning	-138,187	-13%
Paisley Gilmour Street	+131,984	+3%
Johnstone	-129,954	-10%
Ayr	-124,246	-8%
Airdrie	-110,906	-9%

Other methodological variations

A.42 As for 2011/12 and 2012/13 the generic methodology for separating out group stations was not followed for Manchester BR, Wigan BR and Warrington BR. For Warrington BR and Wigan BR we maintained the same split of journeys between the respective stations as seen in 2010/11 at a flow and route code level. For Manchester BR the split was maintained at the station level.

[10] As all the new Mott MacDonald infills were incorporated into the ODM at the same time, it is not possible to definitively isolate each infill. For the purposes of this exercise, stations within the Glasgow Government Office Region were considered to be those affected by the new SPT infill.

B Appendix – Station Usage File Definition

Station Usage File Definition

B.1 The Station Usage spreadsheet ('Estimates of Station Usage 1415.xlsx') lists the entries, exits and interchanges made at stations throughout England, Scotland and Wales in the financial year 2014/15 (1st April 2014 to 31st March 2015). It also gives details about the entries and exits for different ticket categories. It contains data on entries and exits made at rail stations by passengers using the rail network. The fields included in the Station Usage dataset are shown in Table B.1.

Table B.1: Station Usage file

Field	Description
Station (Name, NLC, TLC)	Station Name, NLC: National Location Code, TLC: Three Letter Code
District, Country, Government Office Region, NUTS2 Code and NUTS2 Spatial Unit for the Station	Station's geographical location
Station Facility Owner (SFO)	The company that is the station facility owner (provided by Network Rail in 2008 and updated as appropriate for changes in status)
Station Group	Name of the Group where applicable. The user of this data may wish to filter on the 'Station Group' column, or create pivot tables, to investigate the results at a group level
PTE Urban Area Station	Stations within the urban areas covered by PTE services are identified with a flag: 'PTE Urban Area Station'
London Travelcard Area	Stations within the urban areas covered by PTE services and TfL services are identified with a flag: 'London Travelcard Area Station'
SRS Code	Strategic Route Section (SRS) code associated with the station
SRS Description	Description of the Strategic Route Section (SRS)
NR Route	High level Network Rail (NR) grouping
CRP Line Designation	Gives the Community Rail Partnership (CRP) Line Designation, if applicable. **Note: this does not include Service Designation Community Rail Partnerships**
OS Grid Northing	The Northing reference for the station, using the Ordnance Survey (OS) grid
OS Grid Easting	The Easting reference for the station, using the Ordnance Survey (OS) grid
Entries (Full, Reduced, Season, Total)	Entries made at the stations split by ticket categories and in total

Field	Description
Exits (Full, Reduced, Season, Total)	Exits made at the stations split by ticket categories and in total
14/15 Entries & Exits	Sum of Entries and Exits for 2014/15
13/14 Entries & Exits	Sum of Entries and Exits for 2013/14
14/15 Interchanges	Total Interchanges made for 2014/15
Large station Flag	Flags change in Entries and Exits greater than 10% for stations with over 10,000 Entries and Exits
Small station Flag	Flags change in Entries and Exits greater than 25% for stations with under 10,000 Entries and Exits
Explanation of large change	Identified reason(s) for large changes for flagged stations
Sources	Links to source(s) of information where appropriate

Regions, Counties and Districts

B.2 For all rail stations, the District, County, Region and NUTS2 Region & Code are provided for the origin and destination to describe the geographical location.

B.3 The source of this data is:

- District or the Unitary Authority – ATOC (dated January 2008) and ORR (dated January 2008);
- District, County & Region – ONS[11] website (dated January 2008);
- NUTS2 Code and Description – ORR (dated January 2010).

Station Codes

B.4 There are a number of stations where it is noted that the station TLC ("Three Letter Code") in the Station Usage dataset is not the same as that used in the ATOC's "Master Station Names" file.[12] In order to maintain consistency with the source data for the Station Usage dataset, i.e. MOIRA2, we have maintained the existing codes but the table below lists the stations where there is a different convention depending on the source.

[11] **http://www.statistics.gov.uk/geography/geographic_area_listings/administrative.asp#04**

[12] **http://data.atoc.org/**

Table B.2: Station Codes – MOIRA2 vs ATOC Master Name

Station Name	Station Usage	ATOC Master List
Liverpool South Parkway	LSP	LPY
Ebbsfleet International	EBB	EBD
Farringdon	FAR	ZFD
Canada Water	CAW	ZCW
London Road Guildford	LON	LRD
Anerley	ANY	ANZ
South Woodham Ferrers	WDF	SOF
North Fambridge	FAM	NFA

C Appendix – Overview of the ORCATS allocation process

Overview of the ORCATS Allocation Process

C.1 This section gives an outline of the Central Allocations File (CAF), which is used in producing the interchange figures, and the ORCATS process which is used to create the CAF.

C.2 Most of the train tickets that are sold are inter-available – the customer has a choice of routes and operators. For example, when a customer buys a ticket to travel from Leicester to Leeds, that customer may travel on various combinations of East Midlands Trains, East Coast, CrossCountry Trains and Northern, and may interchange at Doncaster, Sheffield, Derby or Nottingham. LENNON captures the sale of the ticket, but unless the ticket has stringent route restrictions, the route actually taken by the customer is not recorded.

C.3 The route taken by any particular customer may never be known, but some route options are more attractive than others. The customer is more likely to choose a faster, more frequent service than a slower, less frequent one. This likelihood can be translated into the proportions of customers choosing each route option, on a particular flow. (A 'flow' represents all journeys from a given origin station to a given destination station, irrespective of the route taken.) The revenue received from all customers on that flow should be split between different operators to reflect the proportion of customers which each operator carried.

C.4 ORCATS was developed to model the choice made by the customers, and to allow revenue to be split between operators. It applies passenger choice modelling to the train timetable, to determine the relative attractiveness of different route alternatives. It then weights the results by journey mileage.

C.5 For any given timetable, ORCATS works out the possible routes between each origin and destination, and calculates the percentage of the passengers that are expected to choose each route based on the services in that timetable.

C.6 The output from ORCATS is the Central Allocations File (CAF). This lists the proportion of journeys on each flow (or origin-destination pair) estimated to be made by each route alternative. For journeys involving interchanges, each leg of the journey is listed. By combining this information with the ODM data, which contains journeys for all flows, the number of interchanges occurring at individual stations has been estimated.

D Appendix – Methodology: Non-Station Tickets

Methodology: Non-Station Tickets

D.1 Ticket sales do not always tell us where a passenger is travelling. Ticket sales can be divided into the seven categories listed in table below. Ticket sales data has been converted into an estimate of the actual stations that passengers are travelling from/to.

D.2 The processing of ticket sales data is undertaken in the creation of the MOIRA2 demand matrix, and then subsequently in the creation of the ODM. For each of the flow categories, the table below states where the flow is processed: MOIRA2 or ODM.

Table D.1: Categorisation of ticket sales in LENNON

Flow Category	Description	Processing
Category 1	Origin and Destination Stations Known	No processing required
Category 2	Origin or Destination a Group Station (excl. London BR)	ODM
Category 3	Origin or Destination is London Terminals	ODM
Category 4	Origin or Destination a London Travelcard including Zone 1	ODM
Category 5	Origin or Destination a London Travelcard excluding Zone 1	MOIRA2 Demand Matrix
Category 6	Origin or Destination a London Travelcard Boundary Zone	MOIRA2 Demand Matrix
Category 7	Non-National Rail Stations	MOIRA2 Demand Matrix

D.3 In the descriptions below any reference to the methodology used prior to 2011/12 is drawn from documentation produced by DeltaRail when they were the ORR's consultants producing these statistics. From 2011/12 onwards a number of changes have been made in the methodology in order to better represent the distribution of demand between Group Stations (Category 2) by using passenger count data as described in Chapter 3 and Appendix A of this report.

Category 1 – Origin and Destination Stations Known

D.4 Both the origin and destination were known stations so no further processing is required for such flows.

Category 2a – Origin or Destination a Group with all Stations Having a Ticket Office

D.5 In 2005/06 all origins or destinations that were a group station (with the exception of London BR) were changed to the major station within the group. For example, all ticket sales to or from Reading BR were recoded to Reading.

D.6 In 2006/07 the ODM was based on the journeys from ticket sales to the individual stations within a group. We assumed that passengers travelling to the stations in a group would act in the same way as passengers travelling from the stations in that group. It was believed that this was, in general, a valid assumption to make, and no bias would be introduced into the journey figures.

D.7 From 2007/08 onwards this process is still used where all stations in the group have ticket offices, so that the relative flows from the individual stations are credible.

D.8 For example, in 2006/07 the journeys between stations in the 'Manchester BR' group and Crewe and vice-versa are shown by the column "jnys" in the table below. First the proportion of journeys from each of the individual Manchester stations to Crewe is determined, as shown in column "%split."

D.9 Then these proportions are applied to both the 'Manchester BR to Crewe' and 'Crewe to Manchester BR' flows, giving the breakdowns to individual stations shown in column 'BR portion'. These are added to the base values to give "Total Journeys", before the 'Manchester BR to Crewe' and 'Crewe to Manchester BR' flows are deleted, to avoid double counting. The slight discrepancy between the 'Grand Totals' is due to rounding error.

Table D.2: Example of breaking down journeys to/from a BR group of stations

Orig	Dest	Origin Name	Destination Name	Jnys	%Split	BR portion	Total Jnys
2963	1243	DEANSGATE	CREWE	83	**0.32%**	85	168
2966	1243	MANCH OXF RD	CREWE	5,464	**21.03%**	5,580	11,044
2968	1243	MANCH PICC	CREWE	19,733	**75.95%**	20,152	39,885
2970	1243	MANCH VICT	CREWE	700	**2.69%**	714	1,414
0438	1243	MANCH BR	CREWE	26,533		**Remove**	
1243	2963	CREWE	DEANSGATE	207		1,478	1,685
1243	2966	CREWE	MANCH OXF RD	2,262		97,287	99,549
1243	2968	CREWE	MANCH PICC	8,017		351,349	359,366
1243	2970	CREWE	MANCH VICT	343		12,464	12,807
1243	0438	CREWE	MANCH BR	462,578		**Remove**	
		Grand Total:	525,920			525,918	

D.10 The above methodology has been applied to all flows with more than 1,000 journeys in total, based on sales data, leaving the individual group stations (i.e. not including the 'BR Group NLC to destination' flow). For the smaller flows an average split is applied based on the flow with more than 1,000 journeys.

D.11 Since 2011/12 a number of station passenger counts have been undertaken at individual stations within some of the BR station groups in order to support a revision to how the total demand is split between the individual stations. In 2012/13, 2013/14 and 2014/15 progressively more station groups have a count based methodology for apportioning total demand amongst its member stations. In the 2014/15 Station Usage dataset the following Group Stations use passenger counts to calculate the split between individual stations:

- Bedford BR (Bedford Midland, Bedford St. Johns);
- Canterbury BR (Canterbury East, Canterbury West); ;
- Colchester BR (Colchester, Colchester Town);
- Dorchester BR (Dorchester South, Dorchester West)
- Dorking BR (Deepdene, Dorking, Dorking West);
- Edenbridge BR (Edenbridge, Edenbridge Town);
- Falkirk BR (Falkirk Grahamston, Falkirk High);
- Farnborough BR (Farnborough Main, Farnborough North);
- Helensburgh BR (Helensburgh Central, Helensburgh Upper);
- Hertford BR (Hertford East, Hertford North);
- Maidstone BR (Maidstone Barracks, Maidstone East, Maidstone West);
- Newark BR (Newark Castle, Newark North Gate);
- Portsmouth BR (Portsmouth Harbour, Portsmouth & Southsea);
- Southend BR (Southend Central, Southend East, Southend Victoria);
- Wakefield BR (Wakefield Kirkgate, Wakefield Westgate); and
- Worcester BR (Worcester Foregate Street, Worcester Shrub Hill).

Category 2b – Origin or Destination a Group with some Stations Having no Ticket Office

D.12 For this class of stations the above process breaks down because the proportion of journeys **to** the group stations with no ticket offices will tend to be estimated as zero because the sales **from** those stations are necessarily zero. For these groups bespoke methodology has tended to be used based on the best available data. This year entries and exits for the majority of stations in this group have been obtained by apportioning total station group entries and exits using count data.

D.13 For the remaining stations splits between stations have been fixed at an origin and destination and route code level at the proportions estimated in the 2010/11 dataset.

Category 3 – Origin or Destination is London BR

D.14 This category contained all flows that had London BR as either the origin or destination. In order to assign an appropriate London station on flows where either the origin or destination is London BR (NLC=1072) or a London Travelcard involving Zone 1, we analysed responses from the 2001 London Area Travel Survey (LATS). For journeys from any given station, we established the percentage of passengers using each London terminus.

D.15 For example, if the flow was from Ashford International to London BR, we used our pre-generated table showing the percentage spilt between the alternative London termini for

passengers starting at Ashford International. From this we apportioned the exits between London Bridge, Charing Cross, Victoria and other London termini.

D.16 Stations with small sample sizes were removed from the 2001 LATS data. Where there was insufficient data in the 2001 LATS to generate the split for a particular station, a similar process with the Non London Groups methodology was applied. Firstly for all the flows with more than 1000 journeys leaving London BR and having as a destination the particular station we used split factors as above. However, if the sum of journeys was less than 1000 we assigned to the flow the top origin from the London BR stations.

Category 4 – Origin or Destination a London Travelcard including Zone 1

D.17 All origins and destinations that were London Travelcard Zones that include Zone 1 were converted to 'London BR' under the assumption that they will travel to the same stations as point-to-point passengers and then transfer to another mode. The methodology set out above for Category 3 was then applied.

Category 5 – Origin or Destination a London Travelcard excluding Zone 1

D.18 This category contained all Travelcards that did not include Zone 1, for example Zone R2345 London.

D.19 For flows with origin or destination a London Travelcard (excluding zone 1) we use a set of assumptions based on survey responses from the 2001 LATS. They use the starting station to work out which stations it is possible for the passenger to be travelling to, and also give the proportion of passengers travelling to each of these stations. This is based on the assumption that a passenger holding a Zones 2-6 Travelcard would travel as far as Zone 2.

D.20 This processing is undertaken during the production of the MOIRA2 demand matrix.

Category 6 – Origin or Destination a Boundary Zone

D.21 All origins and destinations that were a London Travelcard Boundary Zone were converted to 'London Travelcard including Zone 1' under the assumption that a passenger travelling from or to a Boundary Zone will hold a Travelcard that includes Zone 1. The methodology set out above for Category 3 was then applied.

D.22 This processing is undertaken during the production of the MOIRA2 demand matrix.

Category 7 – Non-National Rail Stations

D.23 This final category contains all those flows in the original ticket sales data that do not fall into one of the above categories. Refer to Appendix E for a detailed description of this data and what has been included and excluded from the ODM.

D.24 This processing is undertaken during the production of the MOIRA2 demand matrix.

E Appendix – Station Usage Dataset Limitations

Station Usage Dataset Limitations

Limitations of the LENNON data

E.1 The LENNON database captures ticket sales for the entire national rail network from many different input machines. It is as a consequence a very large dataset. With all large data sources there will always be input errors resulting in a certain amount of invalid data. Generally such errors will be small, and are more likely to occur in the journeys rather than revenue fields.

E.2 Checks are performed on the data when the MOIRA2 demand matrix is compiled, but due to the size and complexity of the dataset it is not possible to validate each and every entry.

E.3 We have used similar information extensively in the last ten years or more, and have found the data to be reliable, particularly when examining the data at an aggregated level.

E.4 There are a number of areas where we know that LENNON does not capture the data correctly, or instances where it is not possible to derive passenger journeys from ticket sales data. These areas are expanded upon below.

Known Problems of Data Capture

E.5 The data in LENNON from which the ODM is derived is based on ticket transactions. In order for the data to be included in the ODM it must include an origin station and a destination station. However if this is not the case then the data will automatically be excluded.

E.6 Human error at the point the ticket sale is entered into the input machines will also produce invalid data in LENNON.

Travelcards

E.7 As Travelcards are for multi-modal travel they allow the purchaser to make journeys on the rail system and on other modes. Equally, tickets purchased elsewhere on the local transport system will be valid for rail travel. Therefore LENNON gives only a partial picture of the rail travel in conurbation areas, such as: London, Birmingham, Glasgow, Leeds, Liverpool, Manchester, Newcastle and Sheffield.

E.8 The ODM contains reasonably robust estimates of journeys within London and other conurbation areas where travelcards are widely used. An infill for London Travelcards has been included in the ODM since 2006/07, and an infill for PTE tickets is included from 2008/09.

Return and Single Journey Tickets

E.9 It is possible that on certain routes the cost of a return ticket could be lower than a single ticket. This leads to the cheaper return ticket being purchased even though the passenger has no intention of making the return journey by rail. This results in two journeys being recorded instead of one.

Multiple Tickets

E.10 It is possible to buy special cheaper tickets between certain stations for example under a promotion by one of the train companies. In these cases a local ticket may be bought to gain access to a main station and a second ticket bought for the rest of the journey. This results in two journeys being recorded in the ODM and will not accurately represent the journey undertaken.

Rail Staff Passes

E.11 Prior to the privatisation of the rail network, British Rail employees and their families were eligible to various levels of free or reduced rate rail travel. When the various rail companies were converted to private companies, this benefit often continued.

E.12 If you consider the network as a whole, the effect of staff passes is unlikely to be significant. However, it may be significant on certain routes, for example on routes out of Derby due to large concentration of companies in Derby relating to British Rail both pre and post privatisation.

E.13 Ticketless Travel On every route on the network there will always be passengers who travel without purchasing a ticket. This is referred to as ticketless travel. As LENNON data is derived from ticket transactions it cannot reflect this travel.

Other Rail Systems

E.14 There are a number of rail systems in operation in the country that are not covered by LENNON. For Heathrow Express and Eurostar revenue and journeys data were not available.

Journey Factors

E.15 Ticket transactions are converted into an estimate of the number of journeys made by applying a series of ticket type journey factors. Single and return tickets unambiguously translate into one and two journeys respectively, for season tickets, the factors used represent a rough historic estimate as set out in Appendix Table E.1.

E.16 Ticket periods of other lengths are converted to a number of journeys using a proportion of the monthly journey factor.

E.17 Therefore the journeys data in the ODM represents an assumed number of journeys made based on the ticket type sold and the above journey factors. In particular it should be noted that the journeys data has not been cross-checked against other data sources of the actual number of journeys made on the network.

E.18 These journey factors have been used within the LENNON system for a number of years at their current values. The source of the factors is unclear, and there is some indication that they were based on reasonable estimates of ticket use made in excess of fifteen years ago. It can therefore be argued that these journey factors do not provide an accurate estimate of the number of journeys that result on the rail system at present, or in any ODM.

Table E.1: Journey Factors used in LENNON

Description	Journeys Per Issue
Single Journey Ticket	1
Return Journey Ticket	2
Return Journey 2 Persons	4
3 Day Return/ 6 Single Journeys	6
4 Day Return/ 8 Single Journeys	8
5 Day Return/ 10 Single Journeys	10
6 Day Return	12
5 Day Single	5
1.5 Journeys	1.5
Weekly Ticket	10.3
10 Day Return/ 20 Single Journeys	20
2 Weekly Ticket	22
Seasons-Variable Periods	***
Monthly Ticket	45
Not Used	0
3 Monthly Tickets	135
Not Used	0
6 Monthly Tickets	270
Summary Group Codes	***
Annual Ticket	480
8 Day Ticket	22
22 Day Ticket	44
14 Day Ticket	30
50 Journeys	50
10 Weeks	103

Data Excluded From Station Usage

E.19 Some of the LENNON data has been excluded from the MOIRA2 Demand Matrix, and subsequently from the ODM.

E.20 All the products that were classified into the 'miscellaneous' ticket pot were excluded. These products were:

- Car Parking
- Railcard Sales
- Penalty/Excess Fares
- Seat Reservations
- Sleeper Supplements.

E.21 Also excluded from the analysis were all the flows that had either an Origin or Destination that did not represent a geographical location (these are mainly “I codes”), e.g.

- Rover and Ranger Tickets (except those included in the new ‘Other’ Infill in 2011/12 and subsequent years)
- BritRail Tickets
- Gate passes usually used by staff
- Passenger Charter Discounts
- Headquarters Input Items, other than those which can be identified as TfL or PTE

E.22 Finally for flows that have either Origin or Destination a Private Settlement Code some are included and some are excluded.

- PTE tickets and TfL sold London Travelcard records from LENNON are removed, and replaced with an estimate of all rail travel using these tickets via ‘infill’s to the MOIRA2 demand matrix (refer to Chapter 2).
- PlusBus – all significant flows have been included since 2007/08 and minor flows are excluded.
- Attractions – the rail element of the significant flows have been included since 2007/08, which include:
- Bluewater Shopping Centre
- Alton Towers
- Whipsnade
- Chatsworth House

E.23 All other flows involving Private Settlement are excluded, e.g. Irish Stations.

Control Sheet

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